EMERGENCY ACTION PLAN

LOWER WILLOW CREEK DAM

Lower Willow Creek Drainage District
P.O. Box 197
Hall, Montana 59837

June 1, 1993

Updated May 16, 2000
July 10, 2001
Feb. 3, 2005
June 20, 2006
June 27, 2007

If Lower Willow Creek Dam is failing or failure seems imminent, call:

Granite County Sheriff ..... 911 or 859-3251

Office of Emergency Management 859-2809/3251

Mr. Jim Dinsmore, President 288-3393
Lower Willow Creek Drainage District

Brian James Water Tender Cell- 544-4021

TABLE OF CONTENTS

I. INTRODUCTION

A. Purpose

The purpose of this emergency action plan (EAP) is primarily to safeguard lives and secondarily to reduce property damage to the citizens of Granite County living near the town of Hall and along Lower Willow Creek, Flint Creek and the Clark Fork River in the event of flooding caused by a failure of Lower Willow Creek Dam.

B. Description of Dam

Lower Willow Creek Dam is in Granite County, in Section 2, Township 9 North (T9N), Range 14 West (R14W), and located on Lower Willow Creek, a tributary of Flint Creek. It is owned by the Lower Willow Creek Drainage District, P.O. Box 197, Hall, Montana 59837, and is used for irrigation, stock watering and recreation purposes. Technical data pertaining to Lower Willow Creek Dam and its structures are shown in Appendix A.

C. Access to Dam

Lower Willow Creek Dam is located off of a county road, approximately four miles west of Hall. Note that the county road may become flooded or washed out! In inclement weather conditions, access may require four-wheel drive due to snow, ice, or mud. Emergency alternate access may be achieved overland by all terrain vehicle or snowmobile. The access bridge is rated at 4000 lbs. front axle / 16,000 lbs rear axle. The nearest phone is at the home of Mr. Jim Dinsmore (288-3393).

D. Hazard Area

The evacuation area extends along Lower Willow Creek and the Clark Fork River to a point about one and a half miles downstream of the Bearmouth Campground, as shown in Appendix B. Hazards include the possible inundation of occupied dwellings, State Highway 90 and the Bearmouth Campground. Inundation and evacuation maps are in Appendix B.

E. Responsibility and Authority

Pursuant to the Dam Safety Act, Chapter 15 of Title 85, MCA, the dam owner is responsible for production, coordination, maintenance, and implementation of this emergency action plan. The extent of owner

implementation was defined through coordination of this plan with the County Sheriff and the Office of Emergency Management (OEM) coordinator.

F. Periodic Review/Update

The owner shall review/update this EAP annually. Review/update by a qualified professional engineer will be accomplished as required by the dam's operating permit, but no less than every five years.

G. Approval

By my signature, I acknowledge that I, or my representative, have reviewed this plan and agree to the tasks and responsibilities assigned herein for my department and/or agency.

Signature Date
GRANITE COUNTY SHERIFF'S DEPARTMENT

David S. Hayhurst June 25/01
Signature Date
PRESIDENT, LOWER WILLOW CREEK DRAINAGE DISTRICT

06/05/01
Signature Date
GRANITE COUNTY OFFICE OF EMERGENCY MANAGEMENT COORDINATOR

II. NOTIFICATION PROCEDURES

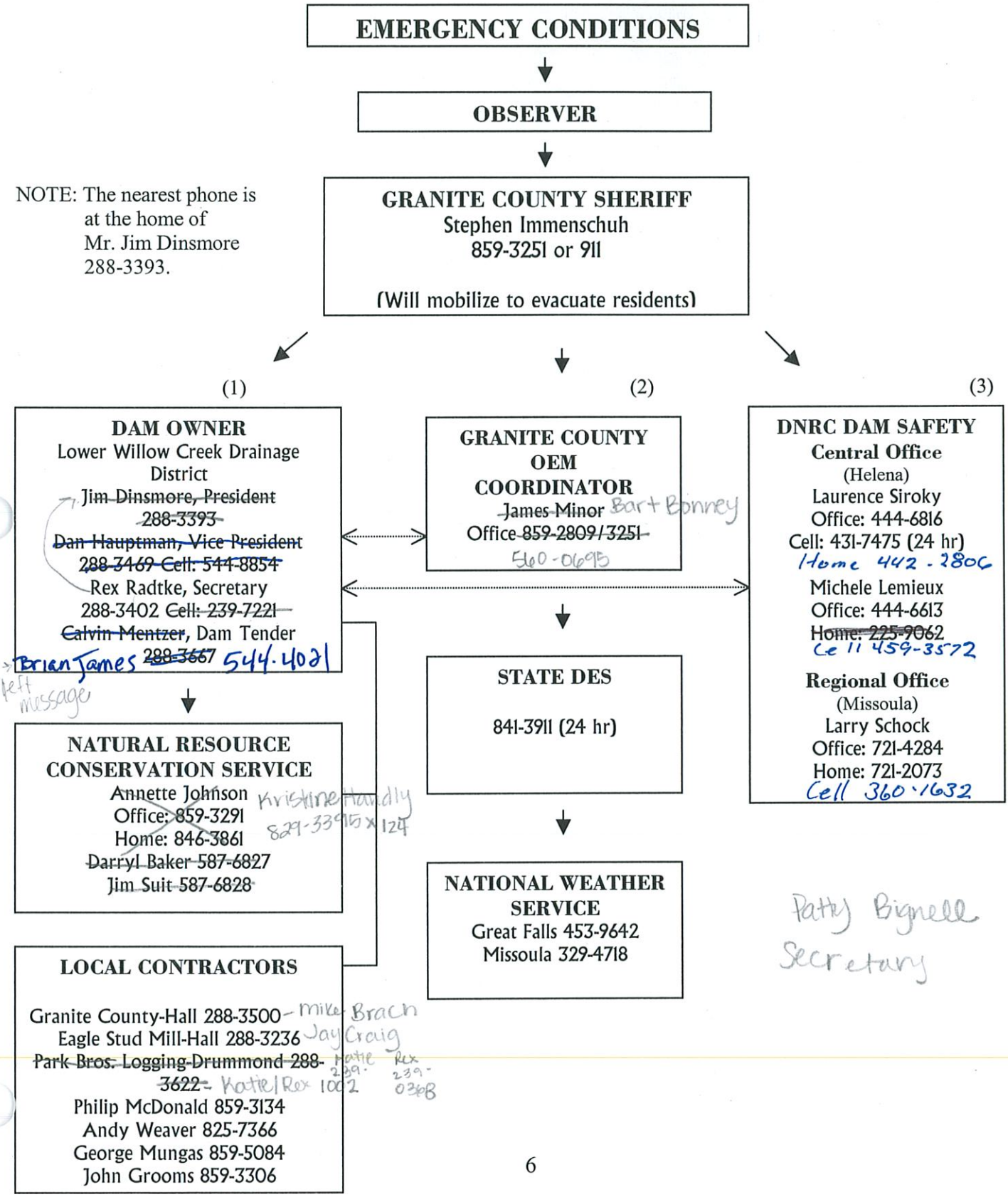
A. Imminent or Actual Failure

It is important that the Dam Owner accurately judge whether the dam is about to fail. If you aren't sure whether the dam is threatened, seek advice from a qualified engineer or call the Dam Safety Section (444-6816/431-7475) of the Department of Natural Resources and Conservation (DNRC). If Lower Willow Creek Dam is failing, two things must be done immediately:

(1) The hazard area downstream from the dam must be evacuated, and

(2) Any steps that might save the dam or reduce damage to the dam or hazard area downstream should be taken. (Refer to the map in Appendix B to determine the areas that are likely to be inundated if the dam fails). The evacuation will be handled according to the county warning plan, and should be initiated as shown in Figure 1.

FIGURE 1
LOWER WILLOW CREEK DAM
ACTUAL OR IMMINENT FAILURE
"NOTIFICATION FLOW CHART"



As dam owner, it is your responsibility to:

1. Call the Sheriff's Dispatch Center (859-3251) and Office of Emergency Management (859-2809/3251). Be sure to say, "This is an emergency." They will call other authorities and the media and begin the evacuation.

2. Do whatever is necessary to bring anyone in immediate danger to safety. This includes someone on the dam, directly below the dam, or boating on the reservoir, or evacuees, if so directed by the sheriff.

3. Keep in frequent contact with Office of Emergency Management staff. They will tell you how to handle the emergency.

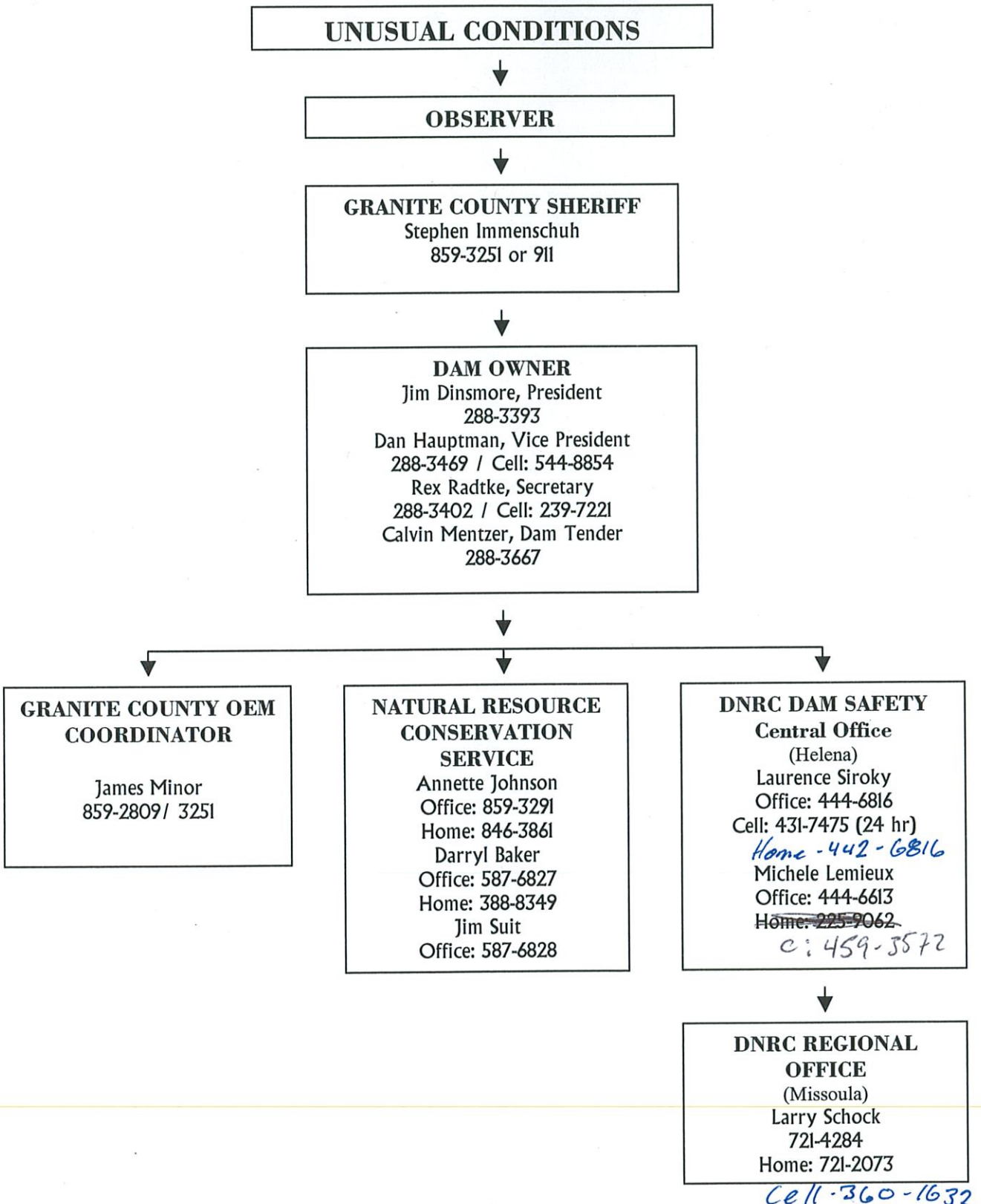
4. If all means of communication are lost:

    a. Try to find out why.
    b. Try to get another radio or telephone that works.
    c. Get someone else to try to reestablish communications. If these means fail, handle the immediate problems as well as you can, and periodically try to reestablish contact with the Office of Emergency Management.

B. Potentially Hazardous Situation

A potentially hazardous situation is an event or condition not normally encountered in the routine operation of the dam and reservoir. Among the unusual occurrences that may affect the dam are dam embankment problems, failure of the spillway or outlet works, heavy precipitation or rapid spring snow melt, landslides, earthquakes, erosion, theft, vandalism, acts of sabotage, and serious accidents. These occurrences may endanger the dam, the public, or the downstream valley and may necessitate a temporary or permanent revision of the dam's operating procedures. Help in these situations can be obtained by notifying those people shown in Figure 2.

FIGURE 2
LOWER WILLOW CREEK DAM
POTENTIALLY HAZARDOUS SITUATION
"NOTIFICATION FLOW CHART"



1. If the dam owner discovers an unusual condition of the dam embankment that could threaten the structure:

    a. Have a qualified engineer inspect the dam as soon as possible to determine whether emergency action is necessary.

    b. Notify the County Office of Emergency Management Coordinator (859-2809/3251) of the problem.

    c. Contact the Dam Safety Program (444-6816/431-7475) of the Department of Natural Resources and Conservation (DNRC).

2. Among the conditions the dam owner should watch for are:

    a. Overtopping of the dam by flood waters
    b. Loss of material from the dam crest due to storm wave erosion
    c. Slides on either the upstream or downstream slope of the embankment as evidenced by
        1. Sloughing
        2. Cracking
        3. Bulging
        4. Scarping
    d. Erosional flows through, beneath, or around the embankment as evidenced by
        1. Excessive seepage
        2. Discoloration of the seepage
        3. Boils on the downstream side
        4. Sinkholes
        5. Changes in the flow from drains
    e. Failure of outlets or spillways due to clogging or erosion
    f. Movement of the dam on its foundation as evidenced by
        1. Misalignment
        2. Settlement
        3. Cracking

3. Before calling either an engineer or DNRC to report a problem, the dam owner shall use the form in Appendix D to ensure sufficient information is provided for the engineer to analyze the problems. In addition, prepare a sketch showing the extent of the problem. Revise the sketch periodically if the problem develops further. Section III includes further guidelines for courses of action to take to mitigate the effect of many problems.

C. Posting of the Notification Flowchart and Distribution of the EAP.

The Notification Flowchart is posted at the dam and a copy of the EAP is in the gatehouse. The Granite County Sheriff's Office and the Granite County OEM Coordinator have copies of the plan.

III. MITIGATION ACTIONS AND PREPAREDNESS

Besides normal monitoring of the dam's condition, which is done at least monthly, the owner will provide continuous monitoring and inspection during and after extreme events such as storms and earthquakes. Information on the magnitude of an earthquake or storm can be obtained from the DNRC Dam Safety Program (444-6816/431-7475). Actions are suggested below to mitigate problems that may develop, but those actions should never be continued at the risk of injury or at the expense of lessening efforts related to evacuation. Monitoring should identify any of the following potential problems.

A. Potential Problems and Immediate Response Actions

1. OVERTOPPING BY FLOOD WATERS

   a. Open outlet to its maximum safe capacity.
   b. Place sandbags along the crest to increase freeboard and force more water through the spillway and outlet.
   c. Provide erosion-resistant protection to the downstream slope by placing plastic sheets or other materials over eroding areas.
   d. Divert flood waters around the reservoir basin, if possible.

2. LOSS OF FREEBOARD OR DAM CROSS SECTION DUE TO STORM WAVE EROSION

   a. Place additional riprap or sandbags in damaged areas to prevent further embankment erosion.
   b. Lower the water level to an elevation below the damaged area.

3. SLIDES IN THE UPSTREAM OR DOWNSTREAM SLOPE OF THE EMBANKMENT

   a. Lower the water level at a rate and to an elevation considered safe, given the slope condition. If the outlet is damaged or blocked, pumping, siphoning, or a controlled breach may be required.

b. Stabilize slides on the downstream slope by

1. weighting the toe area with additional soil, rock, or gravel, and then
2. restoring lost freeboard by placing sandbags at the crest.

4. EROSIONAL FLOWS THROUGH THE EMBANKMENT, FOUNDATION, OR ABUTMENTS

a. Plug the flow with whatever material is available (hay bales, bentonite, or plastic sheeting if the entrance to the leak is in the reservoir basin).
b. Lower the water level until the flow decreases to a non-erosive velocity or stops.
c. Place a protective sand-and-gravel filter or boil ring over the exit area to hold materials in place.

5. FAILURE OF APPURTENANT STRUCTURES SUCH AS OUTLETS OR SPILLWAYS

a. Implement temporary measures to protect the damaged structure, such as closing an outlet or protecting a damaged spillway with riprap.
b. Lower the water level to a safe elevation. If the outlet is inoperable, pumping, siphoning, or a controlled breach may be required.

6. MASS MOVEMENT OF THE DAM ON ITS FOUNDATION (SPREADING OR MASS SLIDING FAILURE)

a. Immediately lower the water level until excessive movement stops.

7. EXCESSIVE SEEPAGE AND HIGH LEVEL SATURATION OF THE EMBANKMENT

a. Lower the water to a safe level.
b. Continue frequent monitoring for signs of slides, cracking or concentrated seepage.

8. SPILLWAY BACKCUTTING, THREATENING RESERVOIR EVACUATION

a. Reduce the flow over the spillway by fully opening the main outlet.
b. Provide temporary protection at the point of erosion by placing sandbags, riprap materials, or plastic sheets weighted with sandbags.
c. When the inflow subsides, lower the water to a safe level.

9. EXCESSIVE SETTLEMENT OF THE EMBANKMENT

a. Lower the water level by releasing it through the outlet pumping, siphoning, or a controlled breach.
b. If necessary, restore freeboard, preferably by placing sandbags.

B. Emergency Supplies and Resources

There is a supply of angular rock (slide rock) on the north side of the dam. There is a large quantity of clayey soils and red shale on the south side of the dam.

C. Local Contractors and Engineers

Local Contractors:

Andy Weaver:	825-7366
Bob Weaver (Drummond):	288-3674
Philip McDonald (Philipsburg):	859-3134
John Grooms:	859-3306
George Mungus:	859-3306

In case of extreme emergency, end loaders, dozers, and other heavy equipment are available from the following:

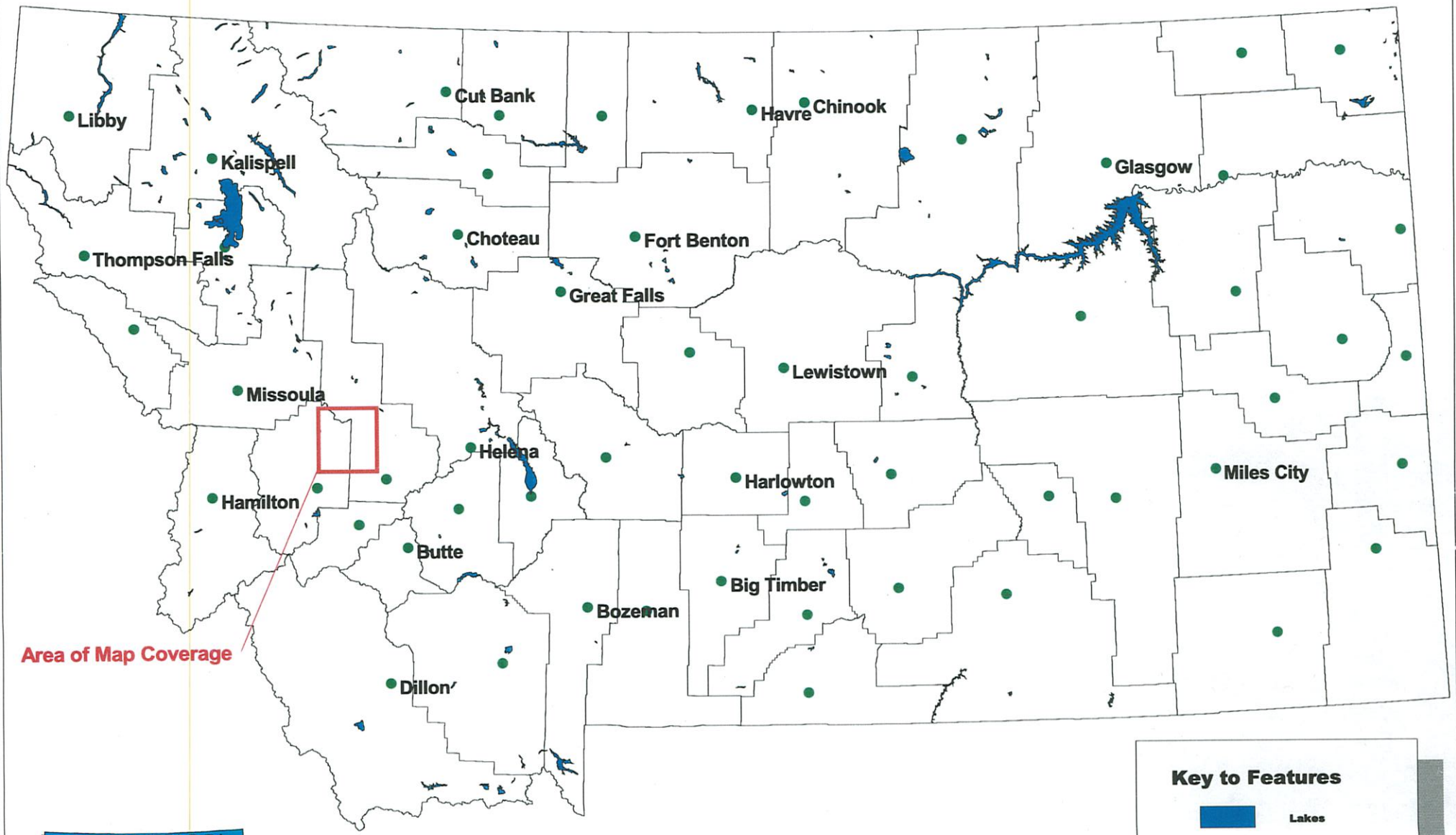
Granite County Maintenance Shop (Hall): 288-3500
Eagle Stud Mill (Hall): 288-3236
Park Bros. Logging (Drummond): 288-3622

Local Engineer:

USDA-NRCS (Missoula) Ms. Kristine Handley: 251-4826 home: 825-7781
Mr. Darryl Baker (Bozeman): 587-6827 home: 388-8349

APPENDICES

Lower Willow Creek Dam Overview Map

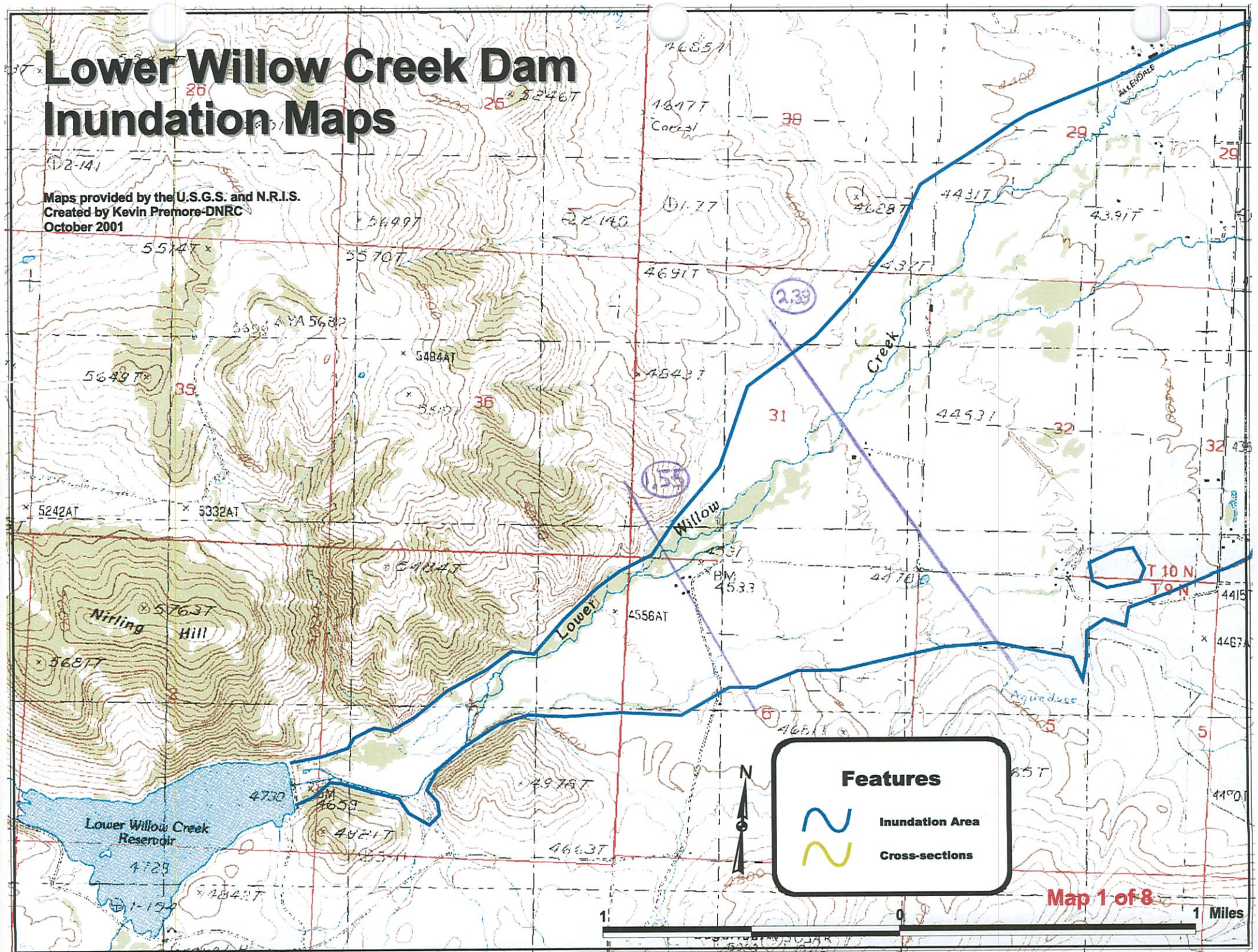


MONTANA DNRC

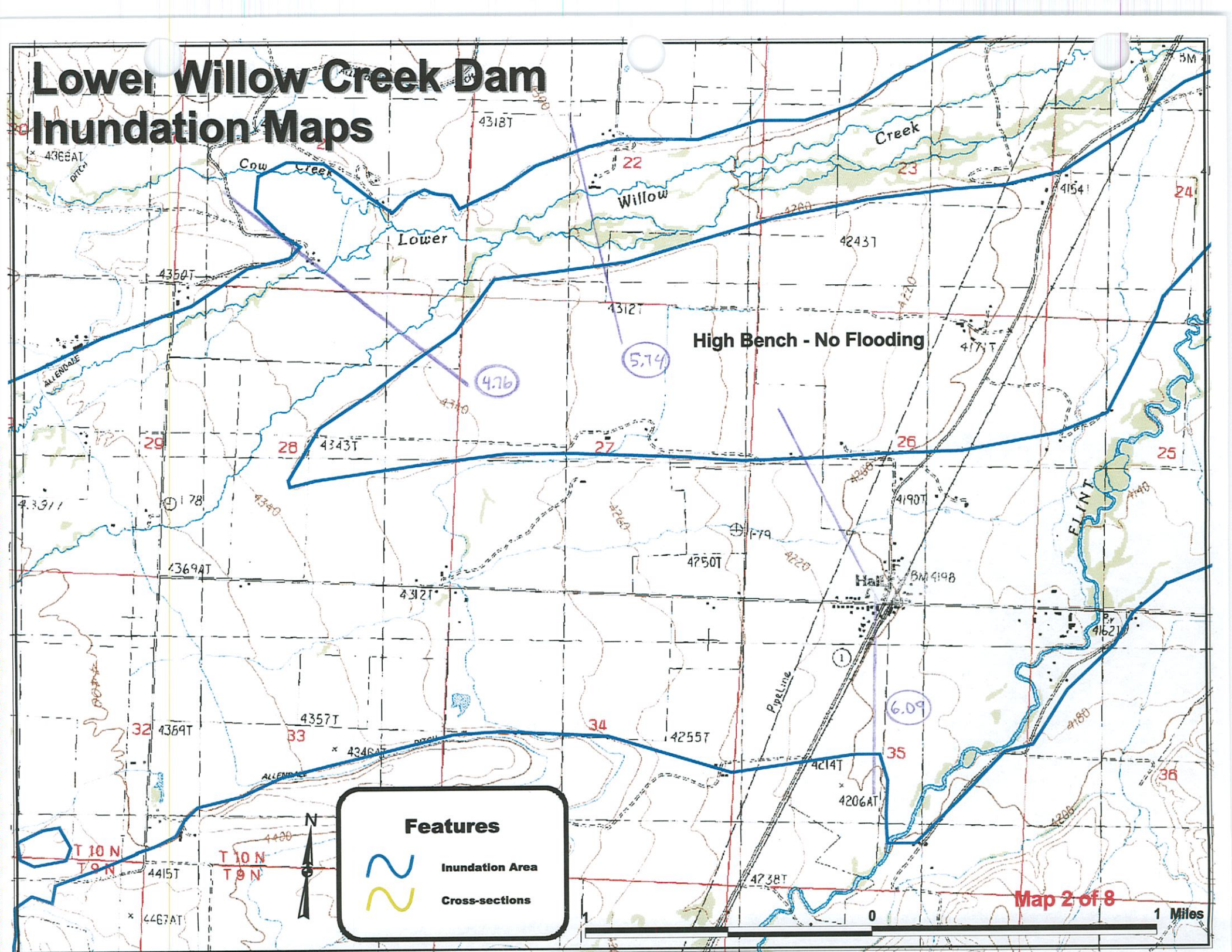
Kevin Premore (October 2001)

Lower Willow Creek Dam Inundation Maps

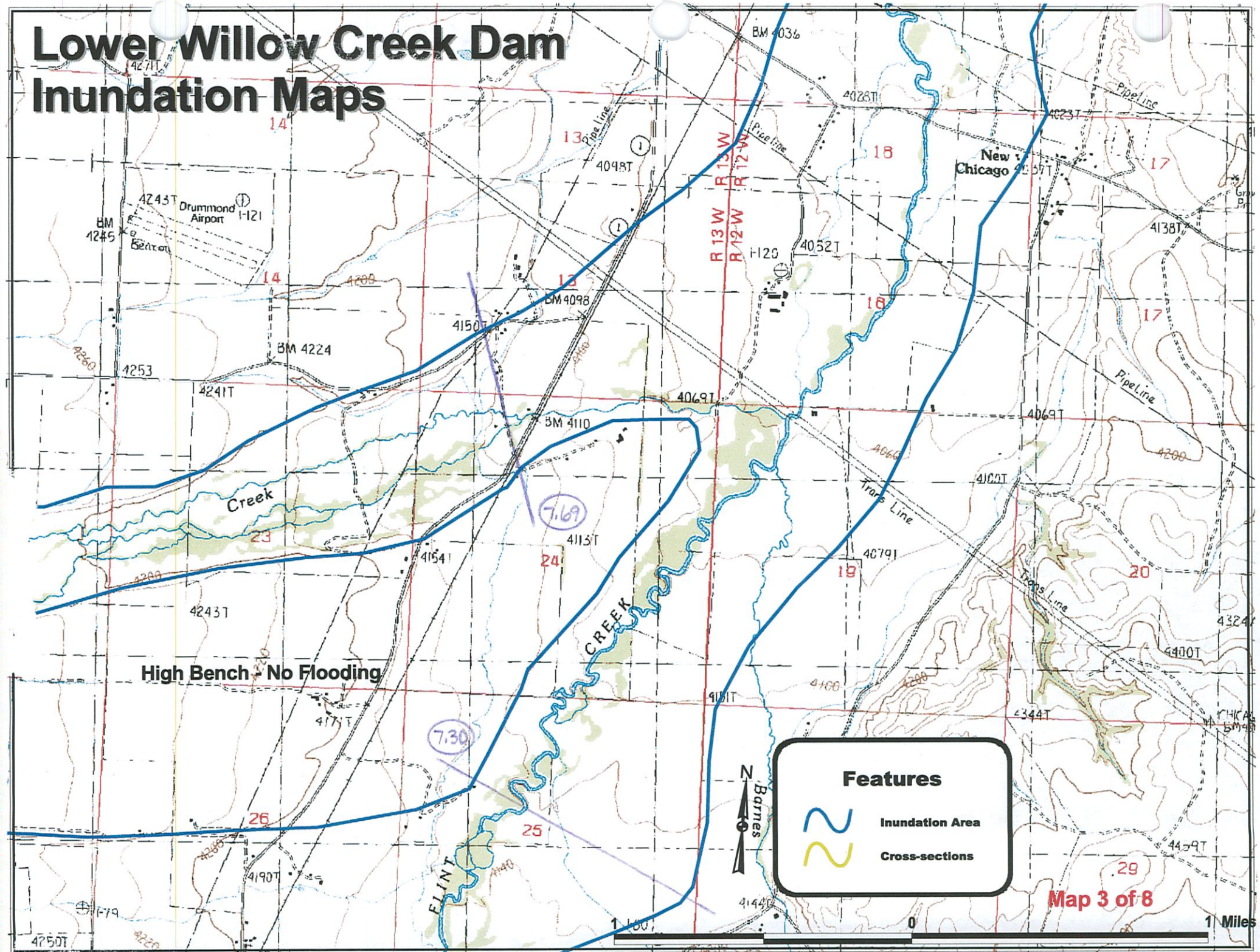
Maps provided by the U.S.G.S. and N.R.I.S.
Created by Kevin Premore-DNRC
October 2001

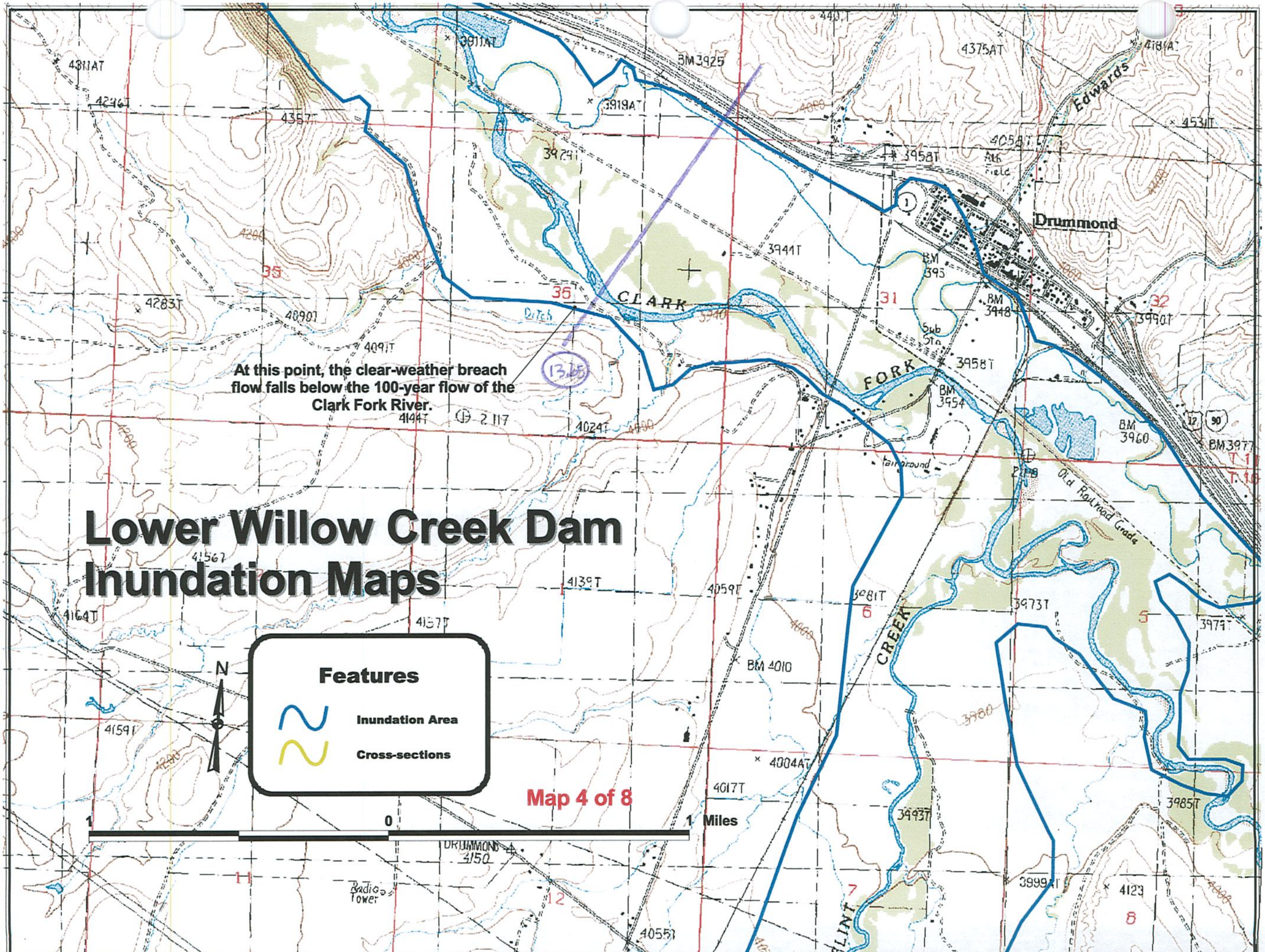


Map 1 of 8

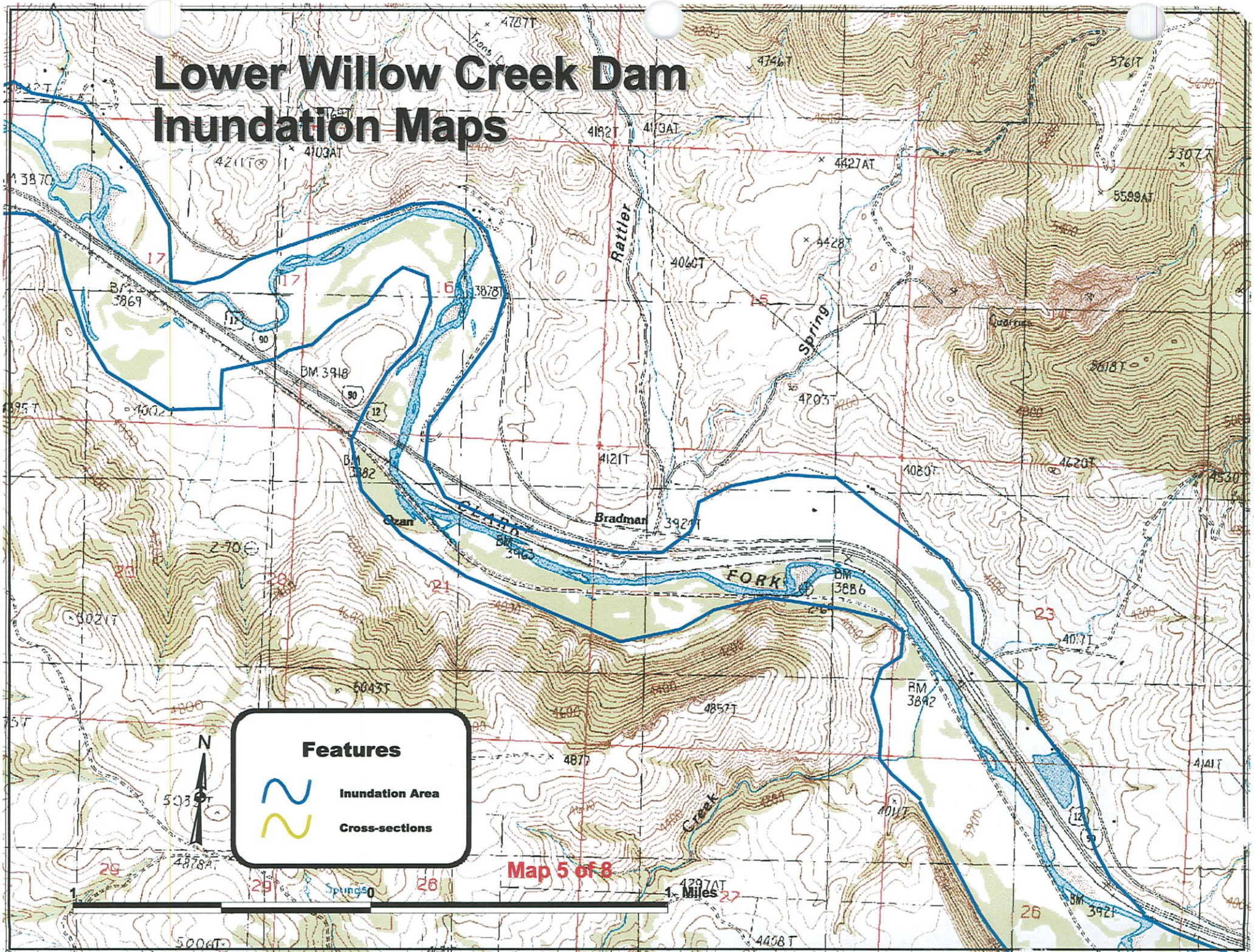

Lower Willow Creek Dam
Inundation Maps
Cow Creek
Lower Willow Creek
High Bench - No Flooding
5.74
4.76
6.09
Pipeline
ELINT
Features
Inundation Area
Cross-sections
N
T 10 N
T 9 N
Map 2 of 8
1 0 1 Miles

Lower Willow Creek Dam Inundation Maps




Lower Willow Creek Dam
Inundation Maps
At this point, the clear-weather breach flow falls below the 100-year flow of the Clark Fork River.
Features
Inundation Area
Cross-sections
Map 4 of 8
1
0
1 Miles
N
Drummond
Edwards
CLARK
FORK
CREEK
Old Railroad Grade
Ditch
Fairground
Sub Sta
Radio Tower
DRUMMOND
BM 3925
BM 4010
BM 3960
BM 3977
BM 3948
BM 3954
3919AT
3911AT
3941T
3958T
3990T
3985T
3999AT
4004AT
4017T
4024T
4059T
4090T
4091T
4139T
4137T
4144T
4156T
4159T
4164T
4283T
4357T
4375AT
4123
4055T
3973T
3979T
3993T
13.65

Lower Willow Creek Dam Inundation Maps



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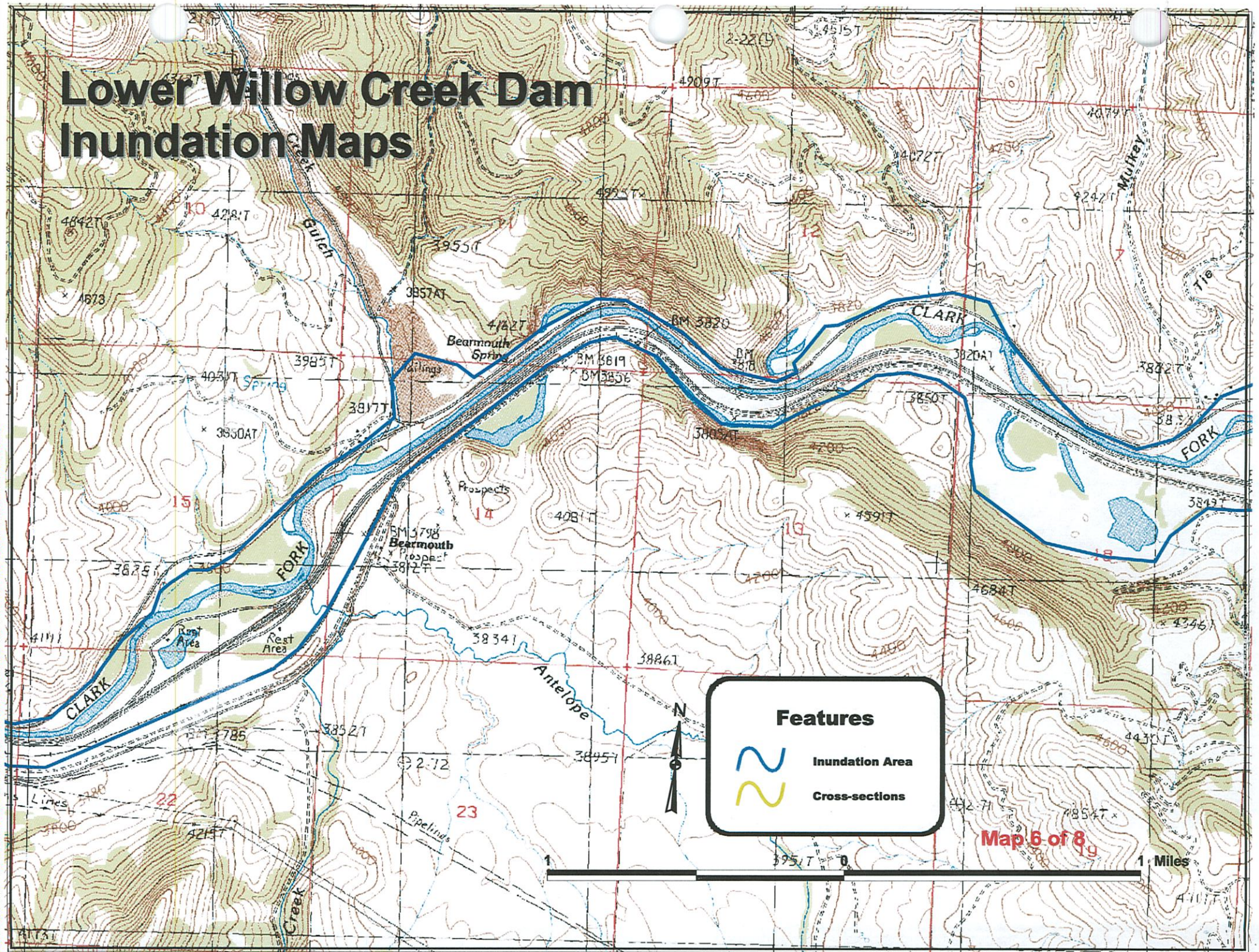

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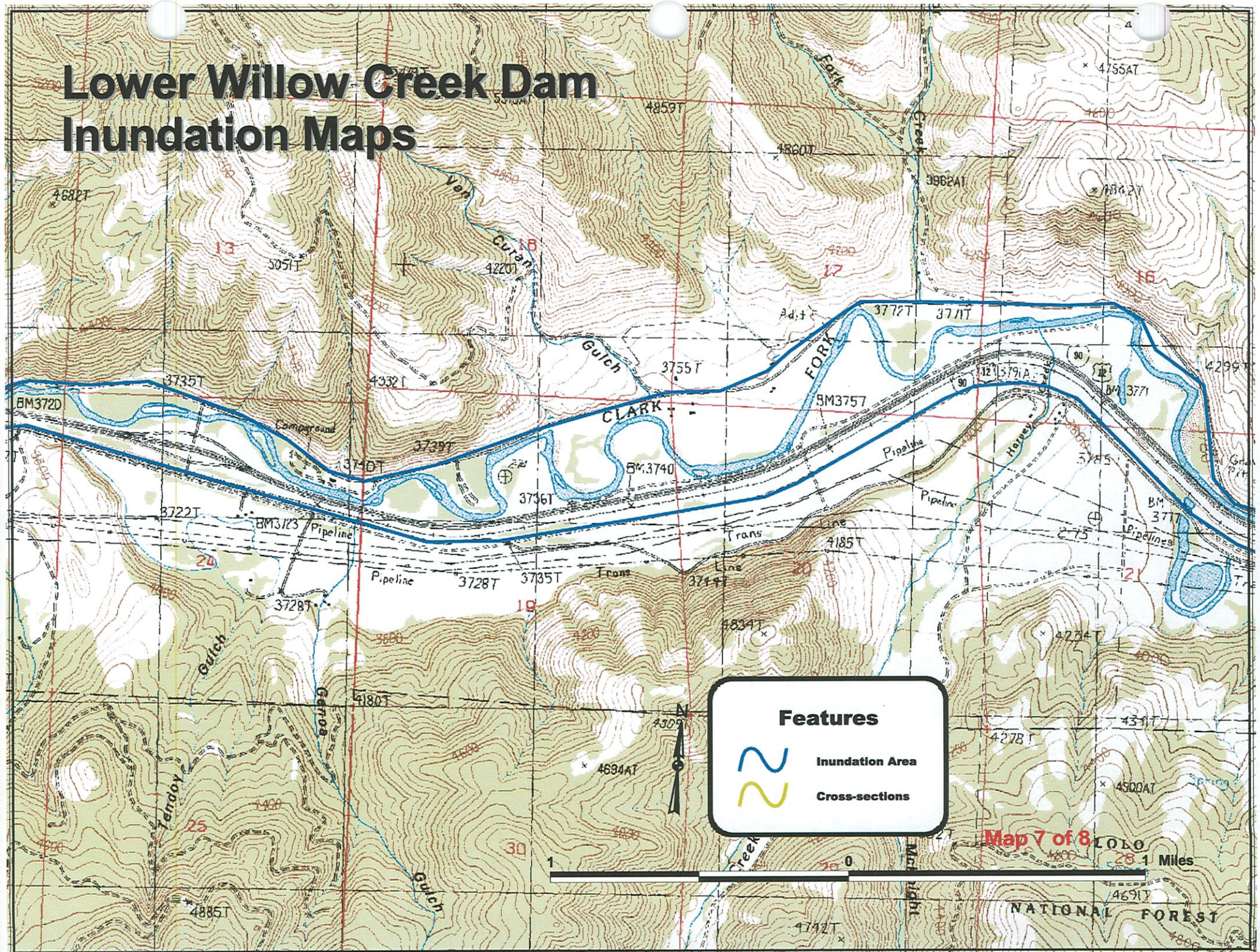
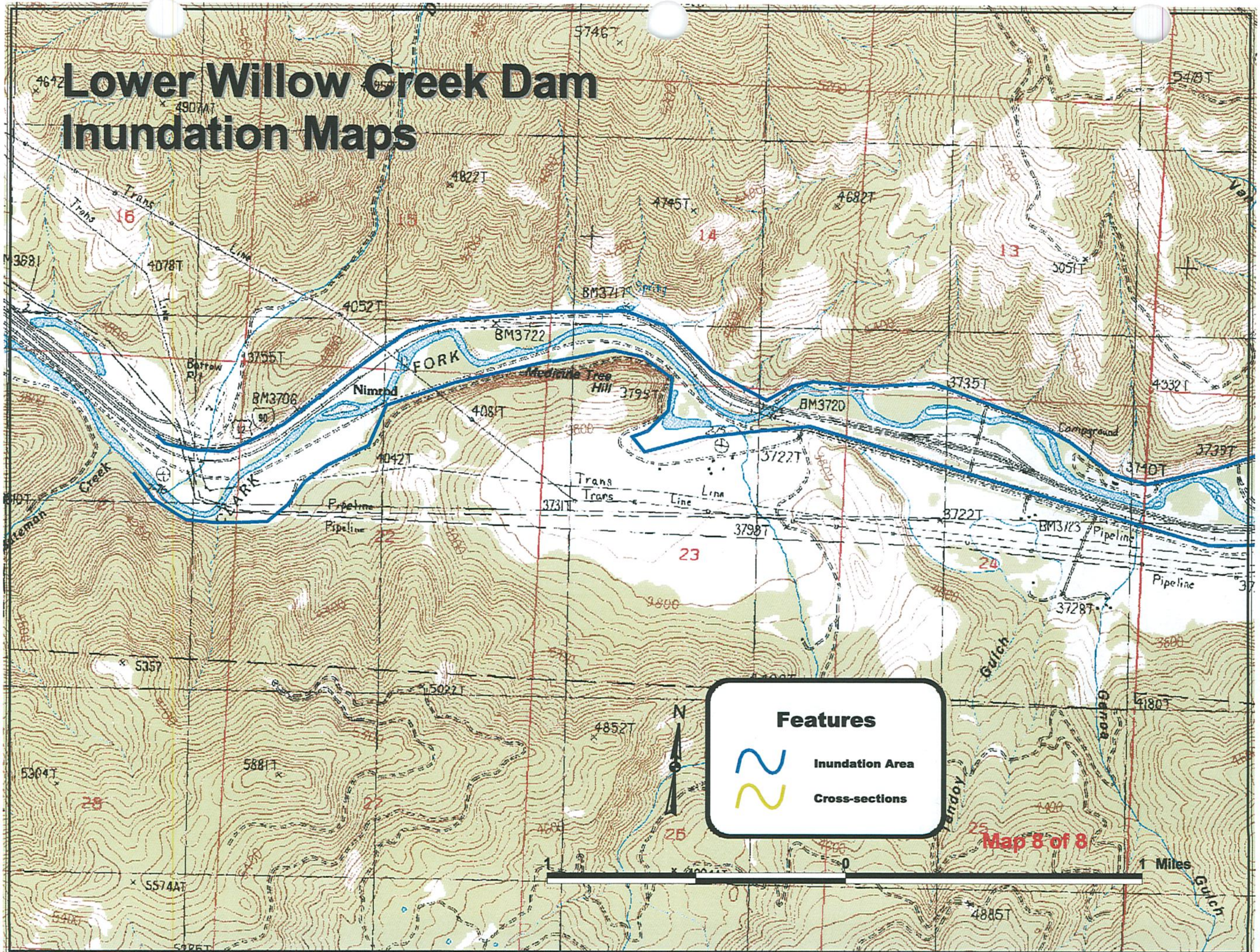


Lower Willow Creek Dam Inundation Maps



Estimated flood wave depths and arrival times for a clear weather breach:

Location	Distance Downstream (Miles)	Arrival Time (Hours)	Peak Value Time (Hours)	Peak Stage Above Streambed (Feet)
	1.55	0.1	1.0	13.8
	2.33	0.3	1.2	10.2
	2.72	0.4	1.3	10.0
	3.81	0.9	1.9	9.4
	4.76	1.3	2.1	7.7
	5.08	1.4	2.2	6.4
	5.74	1.7	2.5	4.2
Hall	6.09	1.7	2.6	4.9
Hall	7.30	2.2	3.2	7.6
	7.69	2.5	3.3	5.3
	9.81	4.1	4.8	11.4
	11.61	5.6	6.4	11.3
Drummond	12.37	6.1	7.0	12.3
	13.65	7.6	8.5	12.0

APPENDIX A Technical Data

APPENDIX A

Technical Data For Lower Willow Creek Dam

Maximum Reservoir Capacity to the Crest of the Dam:.....6,230 acre feet

Normal Reservoir Capacity Measured to the Emergency Spillway Crest: .....4,930 acre feet

Normal Water Depth Measured from the Streambed to the Crest of the Emergency Spillway.....90 feet

Dam Height Measured From the Streambed to the Crest of the Dam:.....96 feet

Dam Crest Width: .....24 feet

Dam Width at Base:.....500 feet

Length of Dam Crest:.....970 feet

Outlet Capacity (reservoir at dam crest): ..... 460 cubic feet per second

Spillway Capacity..... 7,400 cubic feet per second

Date Constructed.....1962

Slope of Upstream Face of Dam (Horizontal to Vertical) ..... 3:1 (upper); 3.5:1 (lower)

Slope of Downstream Face of Dam (Horizontal to Vertical).....2:1

APPENDIX B Inundation and Evacuation Maps

APPENDIX C Telephone Directory

Appendix C

TELEPHONE DIRECTORY

A. Priority One

1. SHERIFF Granite County **[9:00a.m. to 5:00p.m.]**..... 859-3251
EMERGENCY NUMBER 911

2. OFFICE OF EMERGENCY MANAGEMENT Granite County..... 859-2809/3251
EMERGENCY NUMBER 911

Montana Disaster and Emergency Services Division (Helena) .....(406) 841-3911

3. EVACUEES (in upstream-to-downstream sequence)
To be notified by Sheriff's Office.

Willow Creek Branch

Monte Fretzke	288-3434
Jim Mason	288-3304
Gerald Mason	288-3570
Jim Peterson	288-3610
Dave Hauptman	288-3893
Ed Radtke	288-3401
Rex Radtke	288-3402
Francis Lund	288-3308
Bob Lund	288-3205
Thomas McGowan	288-3343
Lee Wright	288-3505
Joe Henderson	288-3530
James Henderson	288-3593
Richard Lacey	288-3359
Drummond Fire Dept.	288-3301
Bearmouth Chalet	825-9950
Maretta McGowan	288-3828
Archie Henderson	288-3461
Scott MacKay	288-3868
Ed James	288-3398
Lee James	288-3827
Forest Martell	288-1313

Hall Branch

Charlie Sutherland	288-0031
Leonard Bray	288-3441
Ron Skinner	288-3872
Clarence Walter	288-3397
Chris Johnson	288-3315
Hall Meat & Grocery	288-3444
U.S. Post Office	288-3334
Foleys	288-3488
Stockmans Bar	288-3842
Donald Bray	288-3337
Vincent Burgmeir	288-3463
Dan Moore	288-0012
Elliot Enmon	288-3619
Charles Parke	288-3192
L. Penner	288-3089
Hall School	288-3440
Larry Pralle	288-3520
Shawn Terrel	288-3631
Julie Enman	288-3451
Scott Struna	288-3592

B. Priority Two

4. LOCAL ENGINEERS

USDA-Natural Resources Conservation Service (Missoula)
Kristine Handley ..... Office: 251-4826;Home: 825-7781
Darryl Baker ..... Office: 587-6827;Home: 388-8349

Larry Schock - Office 721-4284, Cell 360-1632, Home 721-2073

5. MONTANA DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION

Dam Safety Program Engineers: ..... Office: 444-6816/6613

Ms. Michele Lemieux, (Soils and Embankments) ..... ~~Cell: 431-7475~~ Home: 225-9062
cell 459-3572

~~Mr. Terry Voeller (Spillways and Hydrology) ..... Home: 442-9638~~

Mr. Laurence Siroky, Bureau Chief ..... Home: 442-2806
cell 431-7475
office 444-6816

6. NATIONAL WEATHER SERVICE

Missoula 329-4718

Great Falls 453-9642

Billings 652-2314

7. LOWER WILLOW CREEK DRAINAGE DISTRICT

President: Mr. Jim Dinsmore 288-3393

~~Vice President: Mr. Dan Hauptman ..... 288-3469/544-8854~~

Secretary: Mr. Rex Radtke 288-3402/239-7221

Dam Tender: ~~Mr. Calvin Mentzer ..... 288-3667~~
BRIAN JAMES 544-4021

8. BUREAU OF LAND MANAGEMENT 657-6561

9. U.S. FOREST SERVICE, REGIONAL ENGINEERING OFFICE (Missoula) 329-3176

APPENDIX E Plan Distribution List

APPENDIX E

Emergency Action Plan Distribution List

PLAN HOLDER/NUMBER OF COPIES

Lower Willow Creek Drainage District; President Mr. Jim Dinsmore 1
Dam Tender 1
Granite County Sheriff 1
NRCS-Philipsburg Office 1
NRCS-Bozeman Office 1
Granite County Office of Emergency Services 1
State Disaster and Emergency Services – Thompson Falls 1
DNRC Missoula Office 1
DNRC Dam Safety Program 1

APPENDIX E Plan Distribution List

APPENDIX C Telephone Directory

APPENDIX D Dam Incident Report Form

APPENDIX D
DAM INCIDENT REPORT FORM

DATE _____ TIME _____

NAME OF DAM _____

STREAM NAME _____

LOCATION _____

COUNTY _____

OBSERVER _____

OBSERVER TELEPHONE _____

NATURE OF PROBLEM _____

LOCATION OF PROBLEM AREA (Looking Downstream) _____

EXTENT OF PROBLEM AREA _____

FLOW QUANTITY AND COLOR _____

WATER LEVEL IN RESERVOIR _____

IS SITUATION WORSENING? _____

EMERGENCY STATUS _____

CURRENT WEATHER CONDITIONS _____

ADDITIONAL COMMENTS _____